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1. / X / Fee transmittal Form  
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6. / / Microfiche Computer Program (Appendix)  
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(if applicable, all necessary)

Descriptive title of the Invention

Cross References to Related Application

Statement Regarding Fed. Sponsored R &amp; D

Reference to Microfiche Appendix

Background of the Invention

Brief Summary of the Invention

Brief Description of the Drawings (if filed)

Detailed Description

Claim(s)

Abstract of the Disclosure

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Note Box 5 belowi. / / DELETION OF INVENTOR(S)Signed statement attached deleting  
inventor(s) named in the prior application  
see 37 CFR 1.63(d)(2) and 1.33(b).

5. / / Incorporation by reference (useable if Box 4b is checked)

The entire disclosure of the prior application, from which a  
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ACCOMPANYING APPLICATIONS PARTS

8. / X / Assignment Papers (cover sheet &amp; document(s))

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10. / / English Translation Document (if applicable)

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12. / / Preliminary Amendment

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[X] The Commissioner is hereby authorized to charge any other fee required, including the issue fee, in connection with the filing and prosecution of this application, and to the extent necessary, applicant(s) hereby petition for extension(s) of time under 37 CFR 1.136, to be charged to our Deposit Account 11-0345.

Respectfully submitted,  
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# Layered composite based on thermoplastic polymers

The invention relates to a layered composite with at least one  
5 decorative surface and comprising a backing layer made from a  
thermoplastic polymer which is not polypropylene, a decorative  
layer arranged thereupon and a heat-cured layer applied to the  
decorative layer. The present invention also relates to a process  
for producing this layered composite.

10

Layered composites of this generic type are known and essentially  
consist of a core material of wood or at least of wood-like  
material, such as wood-fiber material or separate layers of paper  
compressed with addition of resin, onto which decorative  
15 materials, such as woodgrains or marble effects combined with  
crosslinkable resin materials (overlays) are applied with  
exposure to heat and pressure. Materials of this type are  
described, for example, in the Euwid company brochure.

20 However, the known materials have the disadvantage of a certain  
sensitivity to moisture penetrating from the edges into the core  
layer, because the wood or wood-like material tends to swell when  
exposed to moisture. The compression of the composites is,  
moreover, an expensive process in relation both to the energy  
25 which it requires and to costs, since the compression has to be  
carried out at from 140 to 180 °C and at pressures of up to  
200 N/cm<sup>2</sup>, and there is then also a post-press treatment lasting  
several days in order to prevent deformation of the sheets and  
form an ideally sealed surface.

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For numerous industrial applications, for example in the  
automotive or electrical industry, there is a need for surface  
materials which on the one hand have high scratch resistance and  
on the other hand have relatively high heat resistance and which  
35 moreover can readily be provided with a decoration.

Surfacing material used for some time in furniture manufacturing  
has a number of layers, inter alia a backing layer, a decorative  
layer and a heat-cured layer lying thereupon, which with the aid  
40 of other bonding layers, for example made from paper or from  
adhesive films, produce a decorative layered composite. A layered  
composite of this type is, however, very complicated to produce,  
and often has a high formaldehyde content and exhibits  
undesirable swelling behavior.

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## 2

The earlier Application DE-A 1 97 22 339 discloses a layered composite which comprises a backing layer made from polypropylene, a decorative layer arranged thereupon and a heat-cured layer applied to the decorative layer. However, for  
5 some applications there is a need for a layered composite which, instead of a backing layer made from polypropylene, has a backing layer made from another thermoplastic polymer, and therefore possesses somewhat different mechanical properties.

- 10 It is an object of the present invention to provide a layered composite which is made from a thermoplastic polymer and has at least one decorative surface and is resistant to moisture and to other similar environmental effects, such as chemicals, or glowing cigarettes, and which has improved abrasion resistance  
15 and high compressive strength, and is simple and cost-effective to produce.

We have found that this object is achieved by means of a layered composite with at least one decorative surface and comprising a  
20 backing layer made from a thermoplastic polymer which is not polypropylene, a decorative layer arranged thereupon and a heat-cured layer arranged on the decorative layer.

In the novel layered composite there may be a decorative layer,  
25 and a heat-cured layer applied to the decorative layer, on each side of the backing layer made from the thermoplastic polymer which is not polypropylene, resulting in a sandwich-type structure with the backing layer in the middle.

- 30 The backing-layer material comprises from 0 to 60% by weight, preferably from 0 to 50% by weight, particularly preferably from 0 to 40% by weight, based on the total weight of the mixture, of reinforcing fillers, such as barium sulfate, magnesium hydroxide, talc with an average particle size of from 0.1 to 10  $\mu\text{m}$ , measured  
35 in accordance with DIN 66 115, wood, flax, chalk, glass fibers, coated glass fibers, long or short glass fibers, glass beads or mixtures of these. In addition, the backing-layer material may also comprise the usual additives, such as light stabilizers, UV stabilizers, heat stabilizers, pigments, carbon blacks,  
40 lubricants, flame retardants, blowing agents and the like, in the amounts which are usual and required.

Possible thermoplastic polymers other than polypropylene forming the backing layer are, inter alia, polyethylene, polyvinyl  
45 chloride, polyesters, polycarbonate, polyacrylates and polymethacrylates, polyamides, polyurethanes, polyacetals, such as polyoxymethylene, polybutylene terephthalates and

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5 butadiene,  $\alpha$ -methylstyrene, acrylonitrile, vinylcarbazole, or also esters of acrylic, methacrylic or itaconic acid. The backing layer of the novel layered composite may also comprise recycled material made from these thermoplastic polymers.

10 For the purposes of the present invention, the term polyoxymethylene includes homo- and copolymers of aldehydes, for example of formaldehyde, and of cyclic acetals, which contain recurring carbon-oxygen bonds in the molecule and have a melt flow rate of from 5 to 40 g/10 min, in particular from 5 to 15 30 g/10 min in accordance with ISO 1133 at 230°C and under a load of 2.16 kg.

The polybutylene terephthalate preferably used is a relatively high-molecular-weight esterification product of terephthalic acid and butylene glycol and has a melt flow rate of from 5 to 45 g/10 min, in particular from 5 to 30 g/10 min in accordance with ISO 1133, at 230°C and under a load of 2.16 kg.

Possible styrene copolymers are in particular copolymers with up to 45% by weight, preferably up to 20% by weight, of copolymerized acrylonitrile. Copolymers of this type made from styrene and acrylonitrile (SAN) have a melt flow rate of from 1 to 25 g/10 min, in particular from 4 to 20 g/10 min in accordance with ISO 1133 at 230°C and under a load of 2.16 kg.

30 Other styrene copolymers preferably used comprise up to 35% by weight, in particular up to 20% by weight, of copolymerized acrylonitrile, and up to 35% by weight, in particular up to 30% by weight, of copolymerized butadiene. The melt flow rate of  
35 copolymers of this type made from styrene, acrylonitrile and butadiene (ABS) is from 1 to 40 g/10 min, in particular from 2 to 30 g/10 min in accordance with ISO 1133, at 230°C and under a load of 2.16 kg.

40 The backing layer in the novel layered composite may also be a blend, i.e. a mixture of different thermoplastic polymers, for example a blend made from a copolymer of styrene with acrylonitrile and a copolymer made from butadiene and acrylonitrile.

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To achieve very good bonding between the backing layer and decorative layer it can also be useful to insert an intermediate layer as bonding material between the backing layer and the decorative layer. Intermediate layers which can be used are,  
5 inter alia, impregnated paper, a nonwoven or an adhesion promotor, a primer or else an adhesive. The intermediate layer is preferably an impregnated paper or a nonwoven.

The decorative layer may be composed of a polymeric material  
10 which has an embossment or a coloration or a combination of both, for example in the form of a ready-to-use laminate. However, the decorative layer may also be composed of paper or of a fabric or of a paper-like or fabric-like or wood-like or metal-like material. Examples of these would be decorative layers made from  
15 an aluminum-like material or from a stainless-steel-like material, or else from a wood-, cork- or linoleum-like material.

The heat-cured layer (overlay) arranged on the decorative layer is composed of a thermosetting polymeric material, for example of  
20 a paper impregnated with melamine resin or with urea resin and crosslinked by exposure to pressure or heat during the production of the layered composite. Materials of this type are known per se and, inter alia, obtainable in the form of ready-to-use laminates from Melaplast in Schweinfurt, Germany.

25 In accordance with the invention the layer combination of decorative layer plus overlay (impregnation material) may if desired be arranged unilaterally or bilaterally on the backing layer, or on the intermediate layer. It is also possible to apply  
30 to the backing layer or to the intermediate layer a ready-to-use laminate which is composed of the decorative layer and overlay.

The total thickness of the novel layered composite is from 1 to 20 mm, preferably from 5 to 10 mm, and the backing layer makes up  
35 at least 80 %, preferably at least 90 %, of the total thickness.

To produce the novel layered composite, the backing-layer material is used to in-mold coat the materials for the decorative layer and the overlay, and also for any intermediate layer, both  
40 of which are in the form of thin flexible films or impregnated materials or else ready-to-use laminates. For this, the reinforced thermoplastic polymer is heated in an extruder to at least 180°C, preferably at least 200°C, and then, under a pressure of at least 80 N/cm<sup>2</sup>, preferably at least 90 N/cm<sup>2</sup>, is introduced  
45 into the injection-molding chamber of an injection-molding machine into which the films for the decorative layer and heat-cured layer, and also for any intermediate layer used, or

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the ready-to-use laminate, have previously been placed. A holding pressure of at least 10 N/cm<sup>2</sup>, preferably at least 50 N/cm<sup>2</sup>, is maintained while the tool is then cooled to a temperature not below 60 °C, preferably not below 70 °C, within a period of not  
5 more than 4 min, preferably not more than 3 min, and the mold is then removed from the injection-molding compartment.

Surprisingly, it has been found that the layered composite has excellent adhesion between each of the layers if the  
10 abovementioned process conditions are maintained during production of the novel layered composite. To further improve the adhesion between the layers it can be advantageous for the overlay to be subjected to a, preferably bilateral, flame treatment at from 50 to 80 °C before being placed into the  
15 injection-molding chamber.

The novel layered composite has surprisingly good suitability for producing any molding in which a decorative surface is to be combined with particular resistance to chemical, mechanical or  
20 thermal damage. The preferred use of the novel layered composite is for floorcoverings and wall panels. For these applications individual sheet-like moldings, for example, are produced from the novel layered composite and combined by laying together to give a floorcovering or wallcovering. To make this laying  
25 procedure easier in the preferred application for the person skilled in the art, the moldings of the novel layered composite are advantageously equipped laterally with interlocking elements of tongue-and-groove type. Sheet-like moldings produced from the novel layered composites can have projections on one end and on  
30 one side, and on the end and side which are opposite to the projections have recesses which are the geometric mirror image of the projections. This gives a simple way of joining the sheet-like moldings together reliably and with exact matching. The novel layered composites are also suitable as surface  
35 materials for automotive construction and for the electrical industry.

The following examples are intended to describe the invention in still greater detail. The working examples use the following  
40 measurement methods:

- resistance to steam was determined in accordance with EN 438-2.24;
- abrasion resistance was determined in accordance with EN  
45 438-2.6 at from 6000 to 10 000 rpm;

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- compressive strength was determined by the falling-ball test in accordance with EN 438 with 8 mm backing plate, size of impression: 5.5 mm;
- resistance to glowing cigarettes was determined in accordance with EN 438-2.18;
- chemicals resistance was determined in accordance with DIN 51958;
- scratch resistance was determined in accordance with ISO 1518;
- 10 - bond strength was determined by using a razor blade to make cruciform parallel cuts (cross-cuts) in the surface of a molding. An adhesive tape was then pressed onto the cut surface and vigorously pulled off from the surface at an angle perpendicular to the same. If virtually no segments could be removed from the surface with the adhesive tape, the bond strength was graded "+"; if individual segments amounting to up to 10% of the total coverage could be pulled away, the result was graded "+-"; and if more than 10% of the entire surface could be pulled away the result was graded
- 20 "-". Particularly good bond strengths were graded "++".

## Example 1

A talc-reinforced styrene copolymer with 15% by weight of copolymerized acrylonitrile and a talc content of 30% by weight, based on the total weight of the molding composition, was heated to 280 °C and injected, at injection pressure of 110 N/cm<sup>2</sup>, into a shallow injection-molding compartment into which had previously been placed, on the ejector side, a ready-to-use laminate made from overlay and decorative film from Melaplast. A holding pressure of 50 N/cm<sup>2</sup> was maintained while the mold was cooled to 80°C within a period of 2 min. The injection-molding compartment was then opened and the resultant molding was removed. The results of tests on the unilaterally in-mold-coated molding are given in Table 1.

## Example 2

A long-glass-fiber-reinforced styrene copolymer with 15% by weight of copolymerized acrylonitrile and a long-glass-fiber content of 30% by weight, based on the total weight of the molding composition, was heated to 290 °C and injected, at an injection pressure of 110 N/cm<sup>2</sup>, into a shallow injection-molding compartment into which had previously been placed, on the ejector side, the ready-to-use laminate used in Example 1. A holding pressure of 50 N/cm<sup>2</sup> was maintained while the mold was cooled to 80°C within a period of 2 min. The injection-molding compartment



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was then opened and the resultant unilaterally in-mold coated molding was removed. The results of tests on the molding are given in Table 1.

## 5 Example 3

A glass-bead- and long-glass-fiber-reinforced styrene copolymer with 15% by weight of copolymerized acrylonitrile and a glass-bead content of 10% by weight and a long-glass-fiber content of 20% by weight, based on the total weight of the molding composition, was heated to 290 °C and injected, at an injection pressure of 110 N/cm<sup>2</sup>, into a shallow injection-molding compartment into which had previously been placed, on the ejector side, the ready-to-use laminate used in Example 1. A holding pressure of 50 N/cm<sup>2</sup> was maintained while the mold was cooled to 80°C within a period of 2 min. The injection-molding compartment was then opened and the resultant unilaterally in-mold-coated molding was removed. The results of tests on the molding are given in Table 1.

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## Example 4

An unreinforced styrene copolymer with 15% by weight of copolymerized acrylonitrile, was heated to 270 °C and injected, at an injection pressure of 100 N/cm<sup>2</sup>, into a shallow injection-molding compartment into which had previously been placed, on the ejector side, the ready-to-use laminate used in Example 1. A holding pressure of 50 N/cm<sup>2</sup> was maintained while the mold was cooled to 80°C within a period of 2 min. The injection-molding compartment was then opened and the resultant unilaterally in-mold coated molding was removed. The results of tests on the molding are given in Table 1.

## Comparative Example A

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Example 1 was repeated except that instead of a reinforced styrene copolymer with copolymerized acrylonitrile as backing layer the backing layer used was now made from wood fibers. The results of the tests carried out are given in Table 1.

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## Example 5

A long-glass-fiber-reinforced styrene copolymer with 15% by weight of copolymerized acrylonitrile and 10% by weight of copolymerized butadiene (ABS) and a long-glass-fiber content of 30% by weight, based on the total weight of the molding composition, was heated to 290 °C and injected, at an injection

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pressure of 110 N/cm<sup>2</sup>, into a shallow injection-molding compartment into which had previously been placed, on the ejector side, the ready-to-use laminate used in Example 1. A holding pressure of 60 N/cm<sup>2</sup> was maintained while the mold was cooled to 85°C within a period of 2 min. The injection-molding compartment was then opened and the resultant unilaterally in-mold-coated molding was removed. The results of tests on the molding are given in Table 2.

## 10 Example 6

An unreinforced styrene copolymer with 15% by weight of copolymerized acrylonitrile and 10% by weight of copolymerized butadiene (ABS) was heated to 270 °C and injected, at an injection pressure of 100 N/cm<sup>2</sup>, into a shallow injection-molding compartment into which had previously been placed, on the ejector side, the ready-to-use laminate used in Example 1. A holding pressure of 60 N/cm<sup>2</sup> was maintained while the mold was cooled to 70°C within a period of 2 min. The injection-molding compartment was then opened and the resultant unilaterally in-mold-coated molding was removed. The results of tests on the molding are given in Table 2.

## Comparative Example B

Example 5 was repeated except that instead of a reinforced styrene copolymer with copolymerized acrylonitrile and butadiene (ABS) as backing layer the backing layer used was now made from wood fibers. The results of the tests carried out are given in Table 2.

## Example 7

A long-fiber-reinforced polybutylene terephthalate with a long-glass-fiber content of 30% by weight, based on the total weight of the molding composition, was heated to 300 °C and injected, at an injection pressure of 100 N/cm<sup>2</sup>, into a shallow injection-molding compartment into which had previously been placed, on the ejector side, the ready-to-use laminate used in Example 1. A holding pressure of 50 N/cm<sup>2</sup> was maintained while the mold was cooled to 100°C within a period of 1.0 min. The injection-molding compartment was then opened and the resultant unilaterally in-mold-coated molding was removed. The results of tests on the molding are given in Table 3.

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## Example 8

An unreinforced polybutylene terephthalate was heated to 300 °C and injected, at an injection pressure of 100 N/cm<sup>2</sup>, into a  
5 shallow injection-molding compartment into which had previously been placed, on the ejector side, the ready-to-use laminate used in Example 1. A holding pressure of 50 N/cm<sup>2</sup> was maintained while the mold was cooled to 90°C within a period of 1.0 min. The injection-molding compartment was then opened and the resultant  
10 unilaterally in-mold-coated molding was removed. The results of tests on the molding are given in Table 3.

## Comparative Example C

15 Example 7 was repeated except that instead of a reinforced polybutylene terephthalate as backing layer the backing layer used was now made from wood fibers. The results of the tests carried out are given in Table 3.

## 20 Example 9

A long-fiber-reinforced polyoxymethylene with a long-glass-fiber content of 30% by weight, based on the total weight of the molding composition, was heated to 200 °C and injected, at an  
25 injection pressure of 100 N/cm<sup>2</sup>, into a shallow injection-molding compartment into which had previously been placed, on the ejector side, the ready-to-use laminate used in Example 1. A holding pressure of 50 N/cm<sup>2</sup> was maintained while the mold was cooled to 80°C within a period of 1.0 min. The injection-molding compartment  
30 was then opened and the resultant unilaterally in-mold-coated molding was removed. The results of tests on the molding are given in Table 4.

## Example 10

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An unreinforced polyoxymethylene was heated to 200 °C and injected, at an injection pressure of 100 N/cm<sup>2</sup>, into a shallow injection-molding compartment into which had previously been placed, on the ejector side, the ready-to-use laminate used in  
40 Example 1. A holding pressure of 50 N/cm<sup>2</sup> was maintained while the mold was cooled to 70°C within a period of 1.0 min. The injection-molding compartment was then opened and the resultant unilaterally in-mold-coated molding was removed. The results of tests on the molding are given in Table 4.

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## Comparative Example D

Example 9 was repeated except that instead of a reinforced polyoxymethylene as backing layer the backing layer used was now 5 made from wood fibers. The results of the tests carried out are given in Table 4 below.

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Table 1 - SAN -

	Examples				Comparative Example
	1	2	3	4	
Performance in steam	nc	nc	nc	nc	A Delamination, swelling
Abrasion resistance rpm	8000	8000	8000	8000	8000
Compressive strength	<6mm	<5mm	<4.5mm	<7mm	<8mm
Cigarette resistance	nc	nc	nc	nc	nc
Chemicals resistance	resistant	resistant	resistant	resistant	some separation
Scratch resistance	>25N	>30N	>32N	>25N	>28N
Bond strength	+	++	++	+	+
Temperature change from -40°C to +120°C	nc	nc	nc	nc	Delamination, swelling

nc: no change

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Table 2 - ABS -

Examples		Comparative Example	
	5	6	B
Performance in steam	nc	nc	Delamination, swelling
Abrasion resistance rpm	8000	8000	8000
Compressive strength	<6mm	<6.5mm	<8mm
Cigarette resistance	nc	nc	nc
Chemicals resistance	resistant	resistant	some separation
Scratch resistance	>30N	>25N	>30N
Bond strength	++	+	+
Temperature change from -40°C to +120°C	nc	nc	Delamination, swelling

nc: no change

Table 3 - Polybutylene terephthalate -

Examples		Comparative Example	
	7	8	C
Performance in steam	nc	nc	Delamination, swelling
Abrasion resistance rpm	8000	8000	8000
Compressive strength	<5.5mm	<6.5mm	<8mm
Cigarette resistance	nc	nc	nc
Chemicals resistance	resistant	resistant	some separation
Scratch resistance	>30N	>28N	>30N
Bond strength	++	+	+
Temperature change from -40° to +120°C	nc	nc	Delamination, swelling

nc: no change

Table 4 - Polyoxymethylene -

	Examples		Comparative Example
	9	10	
Performance in steam	nc	nc	D Delamination, swelling
Abrasion resistance rpm	8000	8000	8000
Compressive strength	<5.5mm	<6.5mm	<8mm
Cigarette resistance	nc	nc	nc
Chemicals resistance	resistant	resistant	some separation
Scratch resistance	>30N	>29N	>30N
Bond strength	++	+	+
Temperature change from -40°C to +120°C	nc	nc	Delamination, swelling

nc: no change



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It is apparent from Tables 1 to 4 that, compared with the layered composites of Comparative Examples A to D which have wood fibers as a backing layer, the novel layered composites, all of which  
5 comprise a thermoplastic polymer as backing layer (Examples 1 to 10) have greater resistance to steam and glowing cigarettes and also greater heat and chemicals resistance. In addition, the novel layered composites have better mechanical stability, in particular greater abrasion resistance, compressive strength,  
10 scratch resistance and bond strength, than the layered composites of Comparative Examples A to D.

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We claim:

1. A layered composite with at least one decorative surface and comprising a backing layer made from a thermoplastic polymer which is not polypropylene, a decorative layer arranged thereupon and a heat-cured layer applied to the decorative layer.
2. A layered composite as claimed in claim 1, where a decorative layer and a heat-cured layer applied to the decorative layer are present on each side of the backing layer made from a thermoplastic polymer which is not polypropylene.
3. A layered composite as claimed in claim 1, where an intermediate layer is also inserted as bonding material between the backing layer and the decorative layer.
4. A layered composite as claimed in claim 1 and comprising a polystyrene backing layer.
5. A layered composite as claimed in claim 1 and comprising a polybutylene terephthalate backing layer.
6. A layered composite as claimed in claim 1 and comprising a polyoxymethylene backing layer.
7. A layered composite as claimed in claim 1 and also comprising, in the backing layer, from 10 to 60% by weight, based on the total weight of the mixture, of reinforcing material, where this reinforcing material is composed of barium sulfate, magnesium hydroxide, talc, wood, flax, chalk, glass fibers or glass beads.
8. A layered composite as claimed in claim 1, where the decorative layer is composed of a polymeric material which has an embossment or a coloration or a combination of both, or of paper or of a fabric or of a paper-like or fabric-like or wood-like material.
9. A layered composite as claimed in claim 1, where the heat-cured layer arranged on the decorative layer is composed of a thermosetting polymeric material, crosslinked by exposure to pressure or heat during the production of the layered composite.

10. A layered composite as claimed in claim 1, whose total thickness is from 1 to 20 mm and whose backing layer makes up at least 80% of the total thickness.

5 11. A process for producing a layered composite as claimed in claim 1, which comprises using the backing-layer material to in-mold coat the decorative-layer and heat-cured-layer materials, both of which are provided in the form of thin flexible films.

12. A process as claimed in claim 11, wherein the reinforced thermoplastic polymer is heated in an extruder to at least 180 °C and then introduced, under a pressure of at least 80 N/cm<sup>2</sup>, into the injection-molding compartment of an injection-molding machine, into which the films for the decorative layer and heat-cured layer have previously been placed, and then a holding pressure of at least 10 N/cm<sup>2</sup> is maintained while the mold is cooled to 60°C or above within a period of not more than 4 minutes.

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## Layered composite based on thermoplastic polymers

## Abstract

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A layered composite has at least one decorative surface and comprises a backing layer made from a thermoplastic polymer which is not polypropylene, a decorative layer arranged thereupon and a heat-cured layer applied to the decorative layer. An intermediate layer may also be inserted as bonding material between the backing layer and the decorative layer. The decorative layer and the heat-cured layer may also be applied to both sides of the backing layer.

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# Declaration, Power of Attorney

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We (I), the undersigned inventor(s), hereby declare(s) that:

My residence, post office address and citizenship are as stated below next to my name,

We (I) believe that we are (I am) the original, first, and joint (sole) inventor(s) of the subject matter which is claimed and for which a patent is sought on the invention entitled

Layered composite based on thermoplastic polymers

the specification of which

☒ is attached hereto.

☐ was filed on \_\_\_\_\_ as

Application Serial No. \_\_\_\_\_

and amended on \_\_\_\_\_.

☐ was filed as PCT international application

Number \_\_\_\_\_

on \_\_\_\_\_

and was amended under PCT Article 19

on \_\_\_\_\_ (if applicable).

We (I) hereby state that we (I) have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

We (I) acknowledge the duty to disclose information known to be material to the patentability of this application as defined in Section 1.56 of Title 37 Code of Federal Regulations.

We (I) hereby claim foreign priority benefits under 35 U.S.C. § 119(a)–(d) or § 365(b) of any foreign application(s) for patent or inventor's certificate, or § 365(a) of any PCT International application which designated at least one country other than the United States, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate, or PCT International application having a filing date before that of the application on which priority is claimed. Prior Foreign Application(s)

Application No.	Country	Day/Month/Year	Priority Claimed
19858173.4	Germany	16 December 1998	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No

We (I) hereby claim the benefit under Title 35, United States Codes, § 119(e) of any United States provisional application(s) listed below.

\_\_\_\_\_  
(Application Number)

\_\_\_\_\_  
(Filing Date)

\_\_\_\_\_  
(Application Number)

\_\_\_\_\_  
(Filing Date)

We (I) hereby claim the benefit under 35 U.S.C. § 120 of any United States application(s), or § 365(c) of any PCT International application designating the United States, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of 35 U.S.C. § 112, I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR § 1.56 which became available between the filing date of the prior application and the national or PCT International filing date of this application.

**Application Serial No.**

**Filing Date**

**Status (pending, patented,  
abandoned)**

_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

And we (I) hereby appoint **Messrs. HERBERT. B. KEIL**, Registration Number 18,967; and **RUSSEL E. WEINKAUF**, Registration Number 18,495; the address of both being Messrs. Keil & Weinkauff, 1101 Connecticut Ave., N.W., Washington, D.C. 20036 (telephone 202-659-0100), our attorneys, with full power of substitution and revocation, to prosecute this application, to make alterations and amendments therein, to sign the drawings, to receive the patent, and to transact all business in the Patent Office connected therewith.

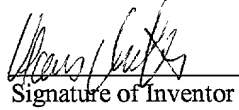
We (I) declare that all statements made herein of our (my) own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

**Declaration**

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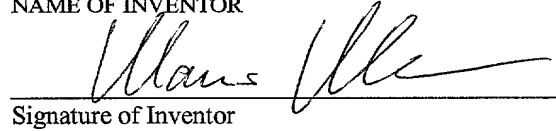
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